

CLAIMS

What is claimed is:

1. An optical pickup in an optical device compatible with first and second recording media having different formats, the optical pickup comprising:

a light device module having a first light beam source and a second light beam source to selectively emit first and second light beams having different wavelengths which correspond to the respective first and second recording media, said light device to selectively emit the first and second light beams according to which one of the first and second recording media is received by the optical device;

a hologram light coupler to separately guide the first and second light beams along a common optical path to the respective first and second recording media;

an optical path changing unit to selectively alter an incident first and second light reflected from the respective first and second recording media to follow a reflected optical path different from the common optical path; and

an objective lens disposed on the common optical path between said optical path changing unit and the respective first and second recording media to focus the selectively emitted first and second light beams on the respective first and second recording media; and

a photodetector

to receive the first and second light beams incident along the reflected optical path from said optical path changing unit, and

to detect an information signal and error signals from the received first and second light beams.

2. The optical pickup of claim 1, wherein said objective lens further comprises:

a light receiving surface to receive the first and second light beams emitted from said light device module, and

a light emitting surface disposed opposite the first and second recording media,

wherein at least one of the light receiving and emitting surfaces is divided into sections by at least one annular region, the sections being concentric with each other and each section having a different aspheric curvature from an aspheric curvature of another section.

3. The optical pickup of claim 1, wherein said hologram light coupler comprises:

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a hologram pattern

to transmit the first light beam incident perpendicular to one surface of said hologram light coupler along a first optical path, and

to diffract the second light beam incident at a non-perpendicular angle to the one surface and transmit portions of the diffracted second light beam that travel along a second optical path parallel to the first optical path of the first light beam to define the common optical path.

4. The optical pickup of claim 3, wherein the first light beam comprises a wavelength of about 650 nm, the second light beam comprises a wavelength of about 780 nm, and the hologram pattern has a maximum pattern depth that is equal to or between 4,000 nm and 7,000 nm.

5. The optical pickup of claim 4, wherein the hologram pattern has a stepped configuration comprising steps.

6. The optical pickup of claim 3, wherein said objective lens comprises:
a light receiving surface to receive the first and second light beams emitted from said light device module, and
a light emitting surface disposed opposite the first and second recording media,
wherein at least one of the light receiving and emitting surfaces is divided into sections by at least one annular region, the sections being concentric with each other and each section has a different aspheric curvature from an aspheric curvature of another section.

7. The optical pickup of claim 1, wherein a positional tolerance between the first and second light beam sources is controlled by adjusting a location of said hologram light coupler on the common optical path between said light device module and said objective lens.

8. The optical pickup of claim 1, wherein said optical path changing unit comprises:
a polarization beam splitter to alter the optical path of the incident first and second light beams by transmitting or reflecting the incident first and second light beams according to polarizations of the incident first and second light beams; and

a quarter-wave plate disposed on the optical path between the polarization beam splitter and said objective lens to change the polarizations of the incident first and second light beams.

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9. An optical pickup in an optical device compatible with first and second recording media having different formats, the optical pickup comprising:

a light device module to selectively emit first and second light beams corresponding to the respective first and second recording media, said light device module to selectively emit the first and second light beams according to which one of the first and second recording media is received in the optical device and along an emitting optical path common to the first and second light beams;

an objective lens disposed on the common optical path to focus the selectively emitted first and second light beams on the respective first and second recording media; and

a photodetector to receive the first and second light beams reflected from the respective first and second recording media, and to detect a signal from the received first and second light beams.

10. The optical pickup of claim 9, wherein said light device module comprises:

a first light source to emit the first light beam,

a second light source to emit the second light beam, and

a light coupler to receive the first and second light beams incident at different angles on a surface, and to transmit and/or diffract portions of the received first and second light beams along the emitting optical path.

11. The optical pickup of claim 9, wherein the light coupler comprises a hologram that diffracts the first light beam into a zeroth order light and a non-zeroth order light, said light coupler to transmit the non-zeroth order light along the emitting optical path.

12. The optical pickup of claim 11, wherein the light coupler transmits 60% or more of the non-zeroth order light along the emitting optical path.

13. The optical pickup of claim 11, wherein the light coupler transmits 80% or more of the non-zeroth order light along the emitting optical path.

14. The optical pickup of claim 11, wherein the hologram comprises a hologram pattern comprising steps and a maximum pattern depth that is equal to or between 4,000 nm and 7,000 nm.

15. The optical pickup of claim 11, wherein the hologram comprises a hologram pattern comprising steps, each of the steps having the same pitch.

16. The optical pickup of claim 11, wherein the hologram comprises a hologram pattern comprising steps, a pitch of the step at a maximum pattern depth is different from pitches of other steps.

17. The optical pickup of claim 16, wherein the pitch of the step at the maximum pattern depth is larger than the pitches of the other steps.

18. The optical pickup of claim 11, wherein the hologram comprises a hologram pattern comprising steps, a pitch of the step at a maximum pattern depth is different from a pitch of an adjacent step.

19. The optical pickup of claim 11, wherein the hologram comprises a hologram pattern comprising steps, a pitch of the step at the maximum pattern depth is the same as the pitch of an adjacent step.

20. The optical pickup of claim 9, wherein said photodetector receives the first or second light beams reflected from the corresponding one of the first and second recording media along a reflected optical path common to the reflected first and second light beams.

21. The optical pickup of claim 20, further comprising an optical path changing unit between said objective lens and said light device module, said optical path changing unit to transmit or reflect the first and second light beams both from said light device module and reflected from the corresponding one of the first and second recording media along the emitting and reflected optical paths, said optical path changing unit comprising

a polarization beam splitter to transmit or reflect the received first and second light beams according to a polarization of the received first and second light beams; and

a quarter-wave plate disposed on the emitting optical path between the polarization beam splitter and said objective lens to change the polarization of the first and second light beams incident from and to the polarization beam splitter.

22. The optical pickup of claim 11, wherein the non-zeroth order light comprises a -1st order light.

23. The optical pickup of claim 12, wherein the non-zeroth order light comprises a -1st order light.

24. The optical pickup of claim 14, wherein the non-zeroth order light comprises a -1st order light.

25. The optical pickup of claim 9, wherein said objective lens comprises an aspherical surface optimized to focus the first or second light on a thicker one of the first and second recording media.

26. A method of reproducing using an optical pickup compatible with first and second recording media having different formats, comprising:

selectively emitting a first light beam corresponding to the first recording medium;
diffracting the first light beam, where at least one of the non-zeroth order lights follows an emitting optical path towards the first recording medium, the emitting optical path being an optical path by which a second light beam reaches the second recording medium;
focusing the one non-zeroth order light on the first recording medium;
receiving the one non-zeroth order light reflected from the first recording medium along a reflected optical path different from the emitting optical path; and
detecting a first signal from the received one non-zeroth order light.

27. The method of claim 26, wherein said diffracting further comprises transmitting 60% or more of the one non-zeroth order light.

28. The method of claim 27, wherein said diffracting further comprises transmitting less than 10% of a zeroth order light of the diffracted first light beam.

29. The method of claim 26, wherein said receiving comprises reflecting the one non-zeroth order light after or prior to being reflected from the first recording medium so as to cause the emitting and reflected optical paths to differ.

30. The method of claim 26, wherein the non-zeroth order light comprises –1st order light.

31. The method of claim 28, wherein the non-zeroth order light comprises –1st order light.

32. The method of claim 29, wherein the non-zeroth order light comprises –1st order light.

33. The method of claim 26, wherein the reflected optical path comprises an optical path by which the second light beam is received after being reflected from the second recording medium.

34. The method of claim 29, wherein the reflected optical path comprises an optical path by which the second light beam is received after being reflected from the second recording medium.

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